CLAIMS

We claim:

1. A method of assembling a core assembly, comprising:
providing at least two core elements;
positioning the core elements in a core assembly;
positioning a smooth surface fastener for entry into the core elements; and
driving the smooth surface fastener into the two core elements.

2. The method of claim 1 wherein the smooth surface fastener is a staple having a crown with two smooth surface tines projecting from the crown; the staple is positioned for entry of one tine into each of the at least two core elements; and the tines are driven into the at least two core elements with one tine in each of the at least two core elements and the crown of the staple across the interface of the two core elements.

3. The method of claim 1 wherein the smooth surface fastener is positioned for entry of the smooth surface fastener through one core element and into the second core element.

4. The method of claim 1 wherein the smooth surface fastener is a staple having a crown and two projecting tines.

5. The method of claim 4 wherein the staple is driven into the two core elements without penetration of the crown of the staple into a core element.

6. The method of claim 3 wherein the smooth surface fastener is a nail.

7. A method of fastening a core assembly together, comprising:
assembling a plurality of core elements into a core assembly;
providing a fastening fixture comprising a plurality of staple guns oriented for insertion of a plurality of staples into the core elements of the core assembly;
positioning the fastening tool adjacent the core assembly with each of the plurality of staple guns located for insertion of a staple into two core elements; and

simultaneously driving a plurality of staples into the core elements of the core assembly to fasten the core assembly together.

8. The method of claim 7 wherein at least one of the plurality of staples is oriented for insertion of a staple with one tine in each of the two adjacent core elements with the staple crown spanning their interface.

9. In a method of assembly of two core elements for an internal combustion engine casting assembly, the improvement comprising retaining the at least two core sand elements in an assembly thereof by driving a smooth surface fastener to span an interface between the at least two core sand elements.

10. The improvement of claim 9 wherein the smooth surface fastener is a staple having a crown and two spaced projecting tines with one tine driven into each of the two core elements so the crown of the staple spans the interface between the two core elements.

11. In a method of assembly of an internal combustion engine head casting assembly comprising at least two core sand elements assembled at an interface, the improvement comprising fastening the at least two core sand elements of the head casting assembly together by providing at least one smooth surface fastener passing through one of said core sand elements, the interface, and into the other core sand element.

12. The improvement of claim 11, wherein the smooth surface fastener driven through said core sand element, the interface and into the other core sand element by an air-driven gun.

13. The improvement of claim 12, wherein the smooth surface fastener is a nail.

14. The improvement of claim 12, wherein the smooth surface fastener is a staple.

15. A method of manufacture of an internal combustion engine head, comprising:

forming a plurality of core sand elements adapted for interengagement in positions forming a core assembly for casting an internal combustion engine cylinder head,

assembling the plurality of core sand elements by placing them together in their interengaging positions to form a core assembly with an internal cavity adapted to cast an internal combustion engine head,

placing the core assembly on a moving belt conveyor and moving the core assembly to a fastening station,

intercepting the movement of the core assembly on the moving belt conveyor and stopping the core assembly,

sensing the presence of the core assembly,

lifting the stopped core assembly from the moving belt conveyor to a pre-determined fastening position above the moving belt conveyor,

positioning a plurality of smooth surface fastener guns for insertion of smooth surface fasteners to retain the core sand elements in their assembled positions in the core assembly, each smooth surface fastener gun being positioned to insert a single smooth surface fastener into two adjacent core sand elements for retention of the two adjacent core sand elements in the assembled position,

sensing the insertion of the smooth surface fasteners into the core assembly, and

upon completion of the insertion of the smooth surface fasteners, lowering the fastened core assembly onto the moving belt conveyor and moving the fastened core assembly from the fastening station by the movement of the moving belt conveyor.

16. The method of claim 15 wherein the smooth surface fasteners are staples and the plurality of smooth surface fastener guns are positioned to fasten the core assembly together by inserting one tine of a staple into only one of two adjacent core sand elements and inserting the other tine of the staple into only the other of the two adjacent core sand elements with the crown of the staple lying across the interfacing sides of the two adjacent core sand elements,

17. The method of claim 15 wherein the moving belt conveyor is narrower than the core assembly, the core assembly is placed on the narrower moving belt conveyor by a wider belt

conveyor, and the wider belt conveyor is controlled to maintain a minimum time interval between the core assemblies on the narrower moving belt conveyor.

18. The method of claim 17 wherein the stopped core assembly is lifted to the predetermined fastening position by moving a lifting table located under the narrower moving belt conveyor upwardly into engagement with the underside of the core assembly on both sides of the narrower moving belt conveyor.

19. An apparatus for automatically stapling together a plurality of sand core elements in a casting core assembly carried on a moving belt conveyor, comprising:

a movable stop adapted for location adjacent the moving belt conveyor,

a first motor for moving the movable stop between a stop position in the path of core assemblies carried on the moving belt conveyor and a pass position out of the path of core assemblies on the moving belt conveyor,

a proximity sensor located adjacent the stop position of the movable stop,

a reciprocatable lifting table located below the moving belt conveyor, said reciprocatable lifting table having a plurality of lifting rods extending upwardly from the lifting table to terminal end locations just below and on each side of the moving belt conveyor, said plurality of lifting rods being sufficiently spaced apart on said reciprocatable table to reliably engage the underside of casting core assemblies carried by the moving belt conveyor with their terminal ends,

a lifting motor for raising and lowering the reciprocatable lifting table, said lifting motor driving said lifting table upwardly so the plurality of lifting rods extend above the level of the moving belt conveyor and define with their terminal ends a fastening position for casting core assemblies carried thereby,

a pressure-applying roof at the fastening position above the lifting table and moving belt conveyor, said pressure-applying roof including resilient means for engaging the upper sides of the core assemblies at the fastening position to assist in their retention at the fastening position,

a plurality of movable carriers for a plurality of staple guns, each of said plurality of movable carriers being adapted to be driven between a retracted position and a staple insertion position adjacent core assemblies at the fastening position,

a plurality of carrier drivers for driving the plurality of movable carriers between their retracted positions and staple insertion positions,

each of the movable carriers carrying a staple gun, a supply of staples, an actuator for operating the staple gun, and a sensor for sensing the insertion of staples from the staple gun, and

a control having first control means triggered by said proximity sensor for operating the lifting motor and moving the lifting table upwardly so the terminal ends of the lifting rods define the fastening position, second control means for operating the plurality of carrier drivers when the upward movement of the lifting table ceases and moving the plurality of carrier drivers to locate the plurality of staple guns in their staple insertion positions, third control means for operating the staple gun actuators when the carriers have stopped at their staple insertion positions, fourth control means triggered by signals from the plurality of staple sensors for operating the lifting motor lowering the lifting table until the terminal ends of the lifting rods are below the level of the moving belt conveyor and for operating the first motor for moving the movable stop out of the path of core assemblies on the moving belt conveyor, and fifth control means triggered by the proximity sensor for operating the first motor to move the movable stop to its stop position.

20. An apparatus for automatically fastening together a plurality of assembled core sand elements in a core assembly carried on a moving belt conveyor, comprising

first means operable for intercepting, stopping and passing the movement of an assembly of core elements along their path on the moving belt conveyor at a pre-determined position,

second means for sensing the presence and absence of an assembly of core elements at the pre-determined position,

third means for lifting the assembly of core elements to a fastening position and for lowering a fastened core assembly to the moving belt conveyor,

a plurality of fourth means for carrying a plurality of staple guns between retracted positions and staple insertion positions adjacent the assembly of core elements at the fastening position for insertion of staples into the assembly of core elements, and

a plurality of fifth means for sensing when the plurality of staple guns has inserted staples into the assembly of core elements,

control means for operating the first, second, third, fourth and fifth means to place the first means in the path of the assembly of core elements on the moving belt conveyor, to operate the third means when the second means senses a stopped assembly of core elements, to operate the fourth means when the third means has lifted the assembly of core elements to the fastening position, to operate the plurality of staple guns after the plurality of staple guns have arrived at their staple insertion positions, to operate the third means when staples from the plurality of staple guns have been inserted into the assembly of core elements and lower the stapled assembly of core elements onto the moving belt conveyor and to remove the first means from the path of the fastened core assembly on the moving belt conveyor, and to place the first means in the path of core assemblies on the moving belt conveyor when the second means senses that a fastened core assembly has been moved from the pre-determined position.

21. The apparatus of claim 20 wherein the first means comprises a movable stop driven by a motor between a stop position above the level of the moving belt conveyor and a pass position below the level of the moving belt conveyor.

22. The apparatus of claim 21 wherein the movable stop comprises a U-shaped element having two upwardly extending legs with one upwardly extending leg located on each side of the moving belt conveyor, providing stops on each side of the moving belt conveyor, and a compressed air piston-cylinder motor to reciprocate the U-shaped element between the stop position and pass position.

23. The apparatus of claim 20 wherein the third means comprises a lifting table located below the moving belt conveyor, a plurality of lifting rods carried by the lifting table and extending upwardly to terminal ends just below the level of the moving belt conveyor, and a lifting motor for raising and lowering the lifting table, the terminal ends of said lifting rods defining the fastening position for core assemblies with the lifting table in its lifted position.